

May 29, 2012

VIA ELECTRONIC FILING

Marlene H. Dortch, Secretary Federal Communications Commission The Portals 445 12th Street, S.W. Washington, DC 20554

Re: Addendum to Ex Parte Communication of May 22, 2012 – WT Docket 12-4

Dear Ms Dortch:

As an addendum to our ex parte meeting on May 22, 2012, Information Age Economics (IAE) offers this analysis of the non-redacted parts of Verizon Wireless' (VZW) responses, dated May 22, 2012 to questions posed by Rick Kaplan, Chief, Wireless Telecommunication Bureau. These questions were posed in a letter dated May 15, 2012 ("WTB Letter") concerning the proposed auction of its 700 MHz Lower Band frequencies. As best as we can tell the redacted parts of this response refer only to VZW's various efforts and their results to sell its 700 MHz spectrum licenses prior to the announcement of this auction. This communication does not address the questions of VZW's earlier attempts to sell its 700 MHz Lower Band A and B spectrum, or the results these attempts achieved.

As outlined below, our review demonstrates that VZW's non-redacted responses are in several critical aspects incomplete and misleading. They are in some cases fragments of a whole truth that, if fully exposed, would reveal a consistent pattern of anti-competitive behavior and initiatives. These initiatives have now culminated in the proposed formation of a telephone company/cable cartel, including Verizon and four major cable operators, Comcast, Time Warner Cable, Bright House and Cox.¹

In particular we would like to draw attention to two major issues raised by VZW's responses, namely:

- (i) The timing of, and reasons behind, VZW's decision to introduce, and unilaterally deploy, non-interoperability into its 700 MHz Upper C Block LTE deployments, along with the implications of this decision.
- (ii) The validity of VZW's calculations of its allegedly superior spectral efficiency as a core argument and assertion, that it has consistently and persistently put forward to

¹ Information Age Economics, *ex parte* Comments, http://apps.fcc.gov/ecfs/document/view?id=7021920095

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justify its need for additional spectrum, and the importance of approving the specific transfer of AWS spectrum from four cable operators. We present additional evidence to reinforce an analysis, included in an earlier filing by T-Mobile, which showed that VZW's calculation of spectral efficiencies produces a spurious and meaningless metric devoid of any value for comparing how efficiently different individual operators, or collectively all mobile operators in a country, are making use of the spectrum allocated to them².

Open Access and the Non-interoperability of VZW's 700 MHz LTE Deployments

It is hard to determine from VZW's responses exactly what it knew and when, and therefore when and why, it took its various critical decisions about the conditions for deployments (or not) of LTE networks and specifications for LTE devices in various blocks of the 700 MHz band. These decisions are of particular concern in light of the open access conditions attached to VZW's Upper C Block frequencies that it accepted, albeit reluctantly, at the time it acquired this spectrum but then apparently decided to ignore in practice,³ without informing the FCC.

VZW in its responses draws particular attention to two aspects of its considerations with regard to its 700 MHz spectrum:

- (a) The difficulties or challenges associated with network deployments in the Lower Band A block compared to those in the Upper C block as a consequence of FCC rules regarding interference.
- (b) The unique situation it faces as a result of holding licenses in both the Lower and the Upper 700 MHz bands.

Given its holdings in both of these sub-bands, VZW says that were it to deploy networks in all its 700 MHz licenses it would have to introduce an additional duplexer in every device because of the small spectral distance between these two sub-bands, and presumably also the unusual reverse duplex operation of the Upper C Block pair of frequencies. According to VZW, this challenge is particularly difficult because of the sub 1GHz frequencies involved. It is not a challenge or requirement that is faced by other Lower Band A and B block licensees who do not hold Upper C block frequencies. These responses from VZW lead to the following observations:

1. It is remarkable, given the problems of network deployments and devices now identified by VZW in this response, that it was willing to pay much more in terms of \$ per MHz-POP for its Lower Band 700 MHz spectrum than for the Upper C block⁴ in the FCC's 2008 Auction 73. Perhaps VZW did not recognize or appreciate these difficulties it now identifies with the Lower

http://apps.fcc.gov/ecfs/document/view?id=7021903695)

Verizon filed a lawsuit against the ECC in September 2007

² REPLY OF T-MOBILE, USA, INC. TO OPPOSITION TO PETITION TO DENY, Exhibit A, http://apps.fcc.gov/ecfs/document/view?id=7021903695)

³ Verizon filed a lawsuit against the FCC in September 2007 prior to the 2008 Auction 73 for 700 MHz frequencies to have these conditions removed, which however it dropped in the following month. Subsequently the CTIA filed another lawsuit against these conditions, which was also dropped in November 2008 almost 8 months after the completion of Auction 73.

⁴ \$0.76 for the Upper C Block and \$1.46 for the Lower A Block frequencies VZW has said it wants to sell (which exclude the Chicago license VZW intends to swap with Leap Wireless) and \$3.69 for the Lower B Block spectrum.

Band A blocks at the time of the auction, and was therefore not anticipating that the 700 MHz Band would become interoperable. Perhaps VZW only came to appreciate their implications after Auction 73 was completed when it became aware of AT&T/Motorola's subsequent initiative to introduce a new Band Class 17 via the 3GPP into the 700 MHz band, using a forum at which many other Lower 700 MHz band licensees were not present, and therefore had no opportunity to introduce objections to this move, which they have now done⁵.

- 2. One explanation commonly advanced for the relatively lower price of the Upper C block frequencies is that two "open access" conditions were attached to it, namely open devices and open applications. Yet Verizon's Upper C Block devices are not interoperable with any other 700 MHz blocks, including the Lower band B in which AT&T has deployed its 700 MHz LTE networks (the non-interoperability is reciprocal). It has also been reported that VZW has blocked the Google Wallet application on one of its 700 MHz LTE devices, namely the Android-based Samsung Galaxy⁷, although VZW has claimed that this application is different from others in that it requires some proprietary hardware in order to work properly⁸. In other words in practice VZW has ignored and made a mockery of the two open access conditions under which it acquired its Upper C block frequencies. This problems associated with this situation will become even more pronounced if, and when Verizon introduces an LTE-capable iPhone, whose launch is widely expected later this year. We anticipate that VZW will introduce an iPhone that only incorporates a 700 MHz Upper C block capability. In light of the iPhone's popularity with customers, this decision would likely ensure that within the next 12 -15 months there will be many more millions of non-interoperable carrier-specific LTE mobile devices in service in the US market, thereby creating more facts on the ground to justify assertions that will no doubt be made by VZW that reversal of non-interoperability would be impractical and expensive. ⁹ This potential chaos, however, must be laid at the feet of VZW.
- 3. A reasonable deduction from VZW's description of the formidable and unique (to VZW) challenge of including a duplexer in any device that could handle both Upper and Lower band 700 MHz frequencies is that the issue is only one of self-interference, i.e., it does not apply to 700 MHz licensees who deploy only 700 MHz LTE networks and only offer 700 MHz LTE devices that work in the Lower Band. In other words, according to VZW, it is the duplexer challenge that is the basis of its decision to make its 700 MHz LTE devices non-interoperable with the Lower

⁵ For example: Vulcan Wireless *ex parte* presentation to the FCC, Proceeding 11-18, http://apps.fcc.gov/ecfs/document/view?id=7021749799; Coalition for 4G In America, http://ruraltelecomgroup.org/wp-content/uploads/2010/09/4G-Coalition-Ex-Parte-092010.pdf

http://news.cnet.com/8301-1035_3-57337210-94/verizon-blocks-google-wallet-on-galaxy-nexus/

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⁶ Broadcast Spectrum Incentive Auctions White Paper, February 15, 2011, p. 11: "For example, the Commission's application of open access regulation to the Upper 700 MHz C Block demonstrates that the uncertainty injected into the market by such rules has grave consequences on wireless investment. The C Block, which was auctioned as a 22 MHz band made up of four licenses covering the continental United States, sold for approximately half the price of the B Block, even though the B Block was licensed with far less spectrum (12 MHz) covering far smaller license areas (734 covering the continental U.S.)." https://www.cesweb.org/shared-files/edm/Press/Spectrum-Whitepaper Final.pdf

⁷ "Verizon blocks Google Wallet on Galaxy Nexus,"

⁸ Statement from Verizon on Google Wallet, http://news.verizonwireless.com/news/2011/12/pr2011-12-06a.html

⁹ The latest version of the LTE-capable Apple iPad tablet is already offered in two carrier-specific versions, one for AT&T and one for VZW.

700 MHz Band. It would be interesting to know if VZW was aware of this challenge at the time of the 2008 700 MHz auction and, if so, whether it made this finding known to the FCC or any other operators at that time, or prior to the auction, and if not, when it became aware of the problem. Furthermore, it would be interesting to know what engineering analyses or tests VZW has performed itself, as well as the content and timing of any information it received from mobile chipset and device vendors, to confirm and quantify the extent of the duplexer problem, including the costs involved, as well as the timing of the availability of the duplexer and performance implications, if any, for devices that incorporated it. It would be helpful to understand, for example, whether an LTE-only dongle that incorporated the duplexer so as to be interoperable across the Upper and Lower 700 MHz sub-bands would be less expensive than a non-interoperable LTE/EV-DO dongle which would have to incorporate two separate air interface technologies, and would only operate in the Upper 700 MHz Band. An attractively priced LTE-only device might be very attractive to customers, given the superior performance of LTE compared to EV-DO, once VZW's LTE coverage becomes equal to, or even possibly slightly greater than, its EV-DO coverage, which it has announced will be the situation from mid-2013. 10

Spectral Efficiency

VZW has laid great stress in its earlier filings in the Proceeding upon the metric of spectral efficiency, asserting that it is one of the most spectrally efficient operators in the US. Therefore, VZW's motivations and justification for more spectrum, are to meet the needs for additional capacity as efficiently as possible in order to satisfy rapidly rising demands for mobile broadband services and applications. This argument is also strongly implied in in VZW's responses to the WTB letter.

We have noted that an analysis performed by Professor Dennis Roberson, included in a T-Mobile filing on March 26, 2012¹¹, effectively refuted the validity of VZW's methodology for calculating an operator's spectral efficiency. This methodology is based on dividing an operator's total number of customers by the average depth of its spectrum holdings nationwide or in the areas where it holds spectrum licenses. Professor Roberson's alternative methodology, which represents a more honest attempt to compare "apples with apples", yields results that refute VZW's assertion of its superior spectral efficiency and indeed show it to be significantly inferior to T-Mobile's.

We offer the following additional observation to reinforce Professor Roberson's finding that VZW's methodology for calculating spectral efficiency is worthless:

We have used VZW's methodology to calculate the spectral efficiency of China Mobile, and show that on this basis China Mobile is over THREE times more spectrally efficient than VZW (see table below). The "superiority" of China Mobile in this regard is then, on the same basis, three times greater, or even more, compared to other US operators. We note that VZW's methodology is identical to that used by the CTIA to present results as "evidence" that the US mobile sector as a whole is much more spectrally efficient than operators in other countries.

¹⁰ Fran Shammo, Verizon CFO, J.P. Morgan Technology, Media and Telecom Conference, May 16, 2012, http://www22.verizon.com/idc/groups/public/documents/adacct/jpm_vz_transcript.pdf

 11 ibid., REPLY OF T-MOBILE, USA, INC. TO OPPOSITION TO PETITION TO DENY

The Table below presents both types of comparison of spectral efficiency, first by operator, and then by country using the VZW/CTIA methodology:

TABLES: Comparative Spectral Efficiency according to VZW's Methodology

A. Comparison of VZW with China Mobile

	Verizon Wireless	China Mobile	Ratio China Mobile/VZW
Number of subscribers, million	109 (end- 2011)	649.6 (end- 2011)	5.96
Depth of spectrum, MHz	89	165	1.85
Spectral efficiency, subscribers/MHz of spectrum allocated, 000s	1,225	3,937	3.21

Source: Verizon Wireless, China Mobile, IAE

B. International Comparison by Country

The CTIA uses the same methodology in order to calculate spectral efficiency on a national basis, as VZW does to compare spectral efficiency between operators, i.e., it divides the total number of mobile subscribers in each country by the total amount of allocated spectrum available to serve them. The CTIA has published the following Table, covering 10 countries. The calculation for China, a country that the CTIA did not include in this comparison, is included immediately following the CTIA figures:

	USA	Japan	Germany	UK	France	Italy	Canada	Spain	South Korea	Mexico
Subscribers**	322.8M	121.9M	109.8M	75.7M	63.2M	91.2M	25.7M	57.3M	51.8M	95.1M
Average Consumers' Minutes of Use per Month**	777	136	130	195	231	161	369	149	303	191
Average Revenue per minute – A Measure of the Effective Price per Voice Minute**	\$0.03	\$0.21	\$0.10	\$0.10	\$0.13	\$0.11	\$0.10	\$0.16	\$0.08	\$0.04
Efficient Use of Spectrum – Subscribers Served per MHz of Spectrum Allocated	788,418	351,297	178,537	201,867	168,800	243,200	95,185	91,680	191,852	365,769
Spectrum Assigned for Commercial Wireless Use***	409.5 MHz*	347 MHz	615 MHz	375 MHz	375 MHz	375 MHz	270 MHz	625 MHz	270 MHz	260 MHz
Potentially Usable Spectrum in the Pipeline***	50 MHz	400 MHz	Recently auctioned 350 MHz	310 MHz	250 MHz	250 MHz	Up to 200 MHz	59.6 MHz (Recently auctioned 250 MHz)	120 MHz	150 MHz

Source: CTIA, The Wireless Association® Mid-Year 2011

As of March 2012 the three mobile operators in China served a combined 1,020 million customers with estimated total allocated spectrum of no more than 400 MHz, i.e., an "efficient use of spectrum" of 2.55 million subscribers per MHz allocated. In other words, according to calculations that faithfully follow the Verizon/CTIA methodology, China's mobile sector is operating with a spectral efficiency that is an astonishing 3.23 times higher than the US.

It would be interesting to learn from VZW whether it agrees with the finding that China Mobile is much more spectrally efficient than all US mobile operators (including VZW itself), and if so to what techniques or expertise not applied in the US VZW would attribute to this remarkable superiority. If VZW agrees with the results of this application of its methodology to China, it might be worthwhile for all US operators, including VZW, to learn from the Chinese how to increase their spectral efficiency by three or more times, so as to alleviate any potential shortage of bandwidth and change fundamentally VZW's assessment of its spectrum options.

Alternatively, if VZW rejects the finding of superior Chinese spectral efficiency, then an explanation of why its methodology is not applicable to China, yet is to the US, would be welcome, or alternatively an acknowledgment that Professor Roberson's analysis is based on a more valid methodology, which produces results closer to the truth than its own calculations.

Conclusions:

- (1) The sale of VZW's 700 MHz Lower Band A and B spectrum would embed non-interoperability, probably irrevocably, in the US LTE environment, in a unique departure from practice in every other country, and also in violation of long established principles in the US telecommunications market.
- (2) VZW's assertion of its superior spectral efficiency as a key justification of its need for additional spectrum has no foundation, because it is based on an absurd calculation that bears no relation to the cellular structure within which operators deploy their radio

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access networks and seek to maximize the capacity of their licensed spectrum, i.e. their spectral efficiency.

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